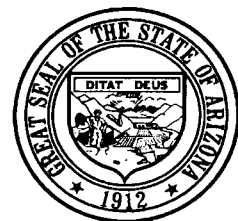


Future Directions



12.1 INTRODUCTION

Over the course of the second management period, many new water policies and laws were adopted by the State of Arizona that aid in the distribution, conservation, augmentation, and management of water supplies within the Pinal Active Management Area (AMA). For the third management period, the Arizona Department of Water Resources (Department) will continue its commitment to develop new legislation and policies to move all of the AMAs closer to their water management goals and to protect their water supplies for future use.

Over the past several years, the Department has conducted a comprehensive assessment of water supplies, demands, and conservation potential for water users in the Pinal AMA. This assessment has been useful in the development of the Third Management Plan. This management plan has led to several conclusions regarding the ability of the water conservation programs and management strategies to reduce groundwater use and move the AMA closer to achieving its management goal. The intent of this chapter is to summarize the water conservation and management programs presented in this plan and to discuss future strategies that may be appropriate to ensure that the AMA's management goal is attained. Many of the management strategies discussed in the future directions section of this chapter are very different from current approaches used by the Department to manage the state's groundwater supplies. Therefore, some of the future management strategies will require amendments to the Groundwater Code (Code) in order to implement them.

12.2 GENERAL CONCLUSIONS

12.2.1 Goal Definition and the Planned Depletion Allowance

The water management goal for the Pinal AMA is to allow development of non-irrigation uses, preserve the agricultural economies for as long as feasible, and preserve water supplies for future non-irrigation uses. This goal is commonly referred to as "planned depletion." In the first and second management periods, the Department did not attempt to quantify the goal of the AMA. For the Third Management Plan, the Department has introduced the concept of a "planned depletion allowance" (PDA). The PDA concept allows the Department to quantify the amount of groundwater that may be withdrawn on an annual basis and still achieve the long-term management goal of the AMA. The PDA has been developed based upon the amount of groundwater in storage to 1,000 feet below land surface in the AMA's two principal subbasins: Eloy and Maricopa-Stanfield. Recent hydrologic studies conducted by the Department estimate that there is approximately 32 million acre-feet of groundwater in storage to 1,000 feet in these subbasins. After discounting the long-term storage credits earned by the Central Arizona Water Conservation District and the Arizona Water Banking Authority (AWBA), there is about 31 million acre-feet available for irrigation and non-irrigation uses. Based upon this estimate, the PDA was determined to be 310,000 acre-feet per year, or enough groundwater for at least 100 years into the future. As discussed in Chapter 8, development and implementation of a groundwater monitoring program will enable the Department to further assess the amount of groundwater in storage to 1,000 feet. Should the current estimate be found to be inaccurate, the PDA will be modified accordingly. The four million acre-feet of groundwater in storage between 1,000 feet and 1,200 feet below land surface will be solely dedicated to non-irrigation uses. For more information on the management goal and the PDA concept, see the preface to Section II.

12.2.2 Maximum Utilization of Renewable Supplies is Essential to Goal Attainment

An important strategy to ensure the attainment of the Pinal AMA management goal is to maximize the use of renewable water supplies. The Department must encourage the importation and use of Central Arizona Project (CAP) water supplies while they are available. Because the agriculture sector accounts for about 98 percent of all the water demand in the AMA, it is critical that CAP water continue to be used by non-

Indian agriculture as a replacement supply for groundwater for as long as supplies of agricultural CAP water are available. During the third management period, groundwater overdraft in the AMA may be significantly reduced through the utilization of CAP water supplies, continued conservation efforts by all water users, and maximum use of effluent. Through the continued use of renewable supplies, groundwater withdrawals can be minimized in the AMA. Since CAP water first became available in 1987, groundwater use in the AMA has been significantly reduced. In 1996, which represented the largest overall water demand for the AMA during the last 17 years, groundwater withdrawals were only 464,617 acre-feet, or 45 percent of the total water demand. On average, annual water demand for non-Indian agriculture has been approximately 765,000 acre-feet. At this average rate of demand, groundwater use in the AMA through 2025 is projected to be between 260,000 to 606,000 acre-feet annually. The balance of this demand will be met by the use of renewable supplies.

12.2.3 Third Management Plan Conservation Programs are Important in Achieving the Goal

Generally, the Third Management Plan conservation requirements for agricultural, municipal, and industrial water users are similar to those assigned during the Second Management Plan. The Department has fashioned into many of the Third Management Plan conservation programs an increased level of flexibility. For instance, the Agricultural Conservation Program includes an alternative program that will be available for holders of irrigation grandfathered rights (IGFRs) that, for whatever reason, cannot meet existing conservation requirements. In the Municipal Conservation Program, gallons per capita per day (GPCD) rates for water providers regulated under the Total GPCD Program will be recalculated annually to better account for changes in population. Under the Industrial Conservation Program, turf-related facilities, such as golf courses, will have a greater incentive to use effluent supplies and thereby reduce their dependence on groundwater. Finally, dairies, which are becoming a major industrial water user in the Pinal AMA, will be able to discount waste water delivered to nearby IGFRs, thus reducing the overall groundwater demand for the AMA. Water conservation has always been an important factor needed to assist the AMA in meeting its management goal, and the increased flexibility and incentives designed into many of the Third Management Plan conservation programs will help reduce the dependency on groundwater supplies during the third management period.

12.2.4 Third Management Plan Augmentation and Recharge Program is Goal Driven and Assisted by AWBA

The most important water management program to assist the Pinal AMA in achieving its management goal is the augmentation and recharge program. The emphasis of the Third Management Plan Augmentation and Recharge Program will be to encourage and facilitate, to the maximum extent possible, the replacement of groundwater use with the efficient use of renewable water supplies. The primary focus during the third management period will be to import, through AWBA, as much excess Colorado River water into the AMA as possible and ensure that the AMA's growing supply of effluent is being beneficially used. In order to have an effective program, the Department will integrate groundwater replenishment and water banking activities to facilitate groundwater management objectives. Finally, the Department will explore other alternatives for future water supply augmentation, such as importing additional surface water supplies through the CAP delivery system.

12.2.5 Need for a Groundwater Monitoring Program to Develop a Regional Recharge Plan and to Measure Goal Attainment

A groundwater monitoring program is needed in the Pinal AMA to more fully understand the area's groundwater resources. More detailed hydrologic information, especially in the Eloy and Maricopa-Stanfield subbasins, is needed in the future in order to better manage the water resources through the implementation of the PDA. Routine monitoring of the water levels will allow the Department to ensure that the PDA is based upon the most current and accurate hydrologic data available. An outgrowth of a

groundwater monitoring program will be the development of a regional recharge plan. A benefit of such a plan would be that groundwater management would be tied closely to local groundwater issues and concerns. Regardless of whether or not a regional water management strategy were to be implemented in the AMA, the importance of a groundwater monitoring program cannot be underestimated. Without a better understanding of existing groundwater supplies, the positive impacts of replacing groundwater use with renewable supplies, and the beneficial nature of periodic flood events, the Department will have difficulty in effectively managing the AMAs water resources. Without such a program, it will be almost impossible to gauge progress towards ensuring that the AMA management goal is realized.

12.2.6 Third Management Plan Water Management Assistance Program will Enhance Goal Attainment

The water management assistance program for the Pinal AMA is designed to provide financial as well as technical assistance to water users interested in developing conservation and augmentation projects. Since their inception in 1990-1991, the Department's conservation assistance and augmentation programs have been effective in educating water users and the general public in methods to augment supplies, conserve water, and help foster a stronger conservation ethic in the community. The Third Management Plan Water Management Assistance Program, therefore, is expected to play an important role in helping the AMA meet its management goal.

12.2.7 Need for a Groundwater Quality Management Program and Other Water Management Strategies

To date, groundwater quality in the Pinal AMA has not been an obstacle to municipal, industrial, or agricultural development. Groundwater quality assessments are needed on a continuing basis to provide the data needed to ensure effective management of the AMA's groundwater resources. The identification of source water quality and the development of area-specific plans to match water quality with the intended use may become important during the third management period. The development of water management strategies for assured water supply, underground storage and recovery, well spacing and impact, and effluent reuse options will also be critical to the future uses of groundwater supplies in the AMA.

12.3 FUTURE DIRECTIONS

Agriculture has been and will continue to be the largest water user in the Pinal AMA well into the next century. Agriculture, therefore, will continue to have the most impact on whether or not the AMA will achieve its long-term water management goal. Historically, municipal and industrial water use is less than 3 percent of the total water demand of the AMA. Water use in these two sectors is closely tied to population growth and by 2025 may represent in excess of 5 percent of the AMA's total water demand.

12.3.1 Interrelationships of Sector Water Use on the Management Goal

12.3.1.1 Agriculture

12.3.1.1.1 Economics

Economics is the single most important factor that influences agricultural water demand, water supply utilization, and future groundwater resources. If groundwater use can be held to a minimum through maximum use of renewable supplies such as excess Colorado River water and effluent, water tables in the Pinal AMA will continue the rebound that they have experienced over the past decade. Water demand and the types of water used to meet this demand have always been directly dependent on economics. During years when the agricultural economy is stagnant, land utilization rates are generally reduced giving rise to a lower overall agricultural water demand in the AMA. Conversely, in years having a strong agricultural

economy, higher water demands are commonplace. The types of water used to meet agricultural water demand in the AMA have historically been determined by the cost of water. During the second management period, both the incentive pricing program for CAP water and the availability of excess Colorado River water offered through the indirect recharge program have provided agricultural water users in the AMA an affordable alternative to groundwater. As a result of these programs, groundwater use has declined significantly. The CAP incentive pricing program is due to end after 2003. It is therefore possible that CAP water costs will increase to levels considerably higher than groundwater. If renewable water supplies cannot be priced at a rate that is competitive with the cost of groundwater, groundwater pumping will undoubtedly increase. In the future, AWBA may reduce the amount of excess Colorado River water it stores in the AMA due to concerns that the storage credits earned through the Department's indirect recharge program may not be recoverable. The reduction of indirect storage of renewable water supplies in the AMA will cause a corresponding increase in groundwater pumping by agriculture. If the utilization of renewable water supplies are reduced in the future, AMA water levels will begin to decline. As water levels decline, the costs of pumping groundwater will increase. At some point, higher groundwater costs will cause a reduction in the amount of agricultural land that is being farmed.

Water costs and the agricultural economy have been the single-most important factor in determining the amount of water use over the past decade. The Department's agricultural conservation requirements have had little effect on water use patterns. When the Second Management Plan final conservation requirements become effective in 2000, it is anticipated that some farmers will be impacted, especially if they choose to grow crops with higher consumptive uses than the crops that were historically grown on their farms from 1975 to 1980. For those farmers choosing to grow their historic crop mix during the third management period, there are expected to be enough flexibility account credits available to ensure compliance with the conservation requirements in most cases.

12.3.1.1.2 Subregional Aspects of Groundwater Use

In response to CAP debt restructuring, the two largest CAP irrigation districts within the Pinal AMA have agreed to groundwater pumping limitations. Generally, the Maricopa-Stanfield and Central Arizona irrigation districts will restrict their groundwater pumping to 250,000 and 240,000 acre-feet respectively. Each district will also further reduce its groundwater pumping in an amount of one acre-foot for each acre-foot of CAP water made available to the district, at usable times, at a cost not exceeding the total cost of pumping groundwater in the district plus 10 percent, up to a maximum reduction of 100,000 acre-feet. Furthermore, each district may pump up to 30,000 acre-feet in meeting its general distribution requirements and to serve lands that are ineligible to receive CAP water under the provisions of the Reclamation Reform Act. Both districts also have strict limitations on the amount of groundwater that may be pumped near the boundaries of neighboring Indian reservations. In the event that CAP water and excess Colorado River water become too costly to purchase, these groundwater pumping limitations would be a greater limiting factor than the Department's Third Management Plan conservation requirements. Should these supplies remain affordable, however, then the conservation requirements would be the greater limiting factor.

In the San Carlos Irrigation and Drainage District (SCIDD), groundwater has been used to supplement surface water supplies from the Gila River. Because SCIDD has always relied heavily on its surface water rights for irrigation, the infrastructure to pump groundwater has never been extensively developed. Water use has been and will always be tied closely to the availability of surface water supplies. Historically, groundwater pumping to supplement surface water deliveries have very seldom exceeded 20 percent of the district's total water demand. It is not anticipated that future groundwater use will be much different than the average historic rate. Over the next several years, SCIDD will be required to line its water distribution system. A lined system will allow the district to better manage their surface water supplies, thereby potentially reducing the districts dependency on groundwater. Because farmers in SCIDD are so dependent on the availability of surface water supplies, water resources have and will probably always be

the limiting factor that will dictate the amount and types of crops that will be planted. It is doubtful, that the Department's conservation requirements will have any significant impact on management decisions or water conservation practices by district farmers.

Farmers in the Pinal AMA whose farms are outside of irrigation districts are dependent solely on groundwater. Groundwater use has been closely tied to each farmer's cost of pumping, the conservation requirement, the amount of flex credits held, and the general agricultural economy. The Department's Third Management Plan conservation requirements could have potentially impacted these farmers more than those within irrigation districts. The Code, however, was amended in 1998, allowing holders of IGFRs that are located outside of irrigation districts and within the same subbasin to purchase flex credits from one another. Although this change has reduced the potential impact of the Department's conservation requirements on these farmers, the conservation requirements will still provide an impetus for farms to employ more efficient water conservation practices.

12.3.1.2 Municipal and Industrial

It is anticipated that water use in municipal and industrial sectors as projected in Chapter 11 will be approximately 47,000 acre-feet by 2025, or about five percent of the Pinal AMA's water demand. The projected water use for both sectors are closely tied to the population projections provided by the Arizona Department of Economic Security (ADES). Over the years, ADES projections have consistently been conservative. Therefore, it is highly probable that municipal and industrial water use may be significantly more than what has been projected. Chapter 11 projections, although conservative, do reflect that both sectors will meet the Third Management Plan conservation requirements. It is further assumed that the Third Management Plan conservation requirements will not hinder future development. In all likelihood, water use will exceed the 2025 projections due to population increases in excess of what has been projected by ADES. It is not unreasonable to expect water use in the municipal and industrial sector to be as much as 10 percent of the total water demand of the AMA by 2025. Should this be the case, only about 25 percent of this demand will be met by renewable supplies.

12.3.2 Impacts of Water Use on the Management Goal

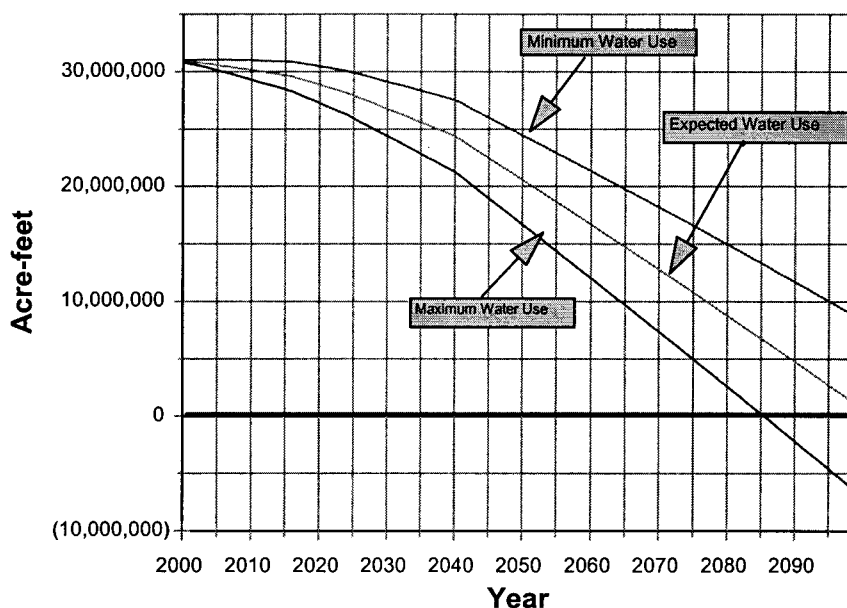
12.3.2.1 Non-Indian Water Use Sectors

Non-Indian agriculture will have the most impact on whether the Pinal AMA will be able to attain its management goal. Non-Indian agricultural water use has been and will continue to be closely tied to the cost of water and the economy. Whether or not the AMA can meet its goal will depend on agriculture's ability to utilize renewable water supplies for as long as they are physically available. If renewable supplies are priced competitively with the cost of groundwater, renewable supplies will most likely be fully utilized by this sector. Through maximizing the use of agricultural CAP water and excess Colorado River water in the early years when such renewable supplies are plentiful, the AMA will be able to build up its groundwater resources for those years when these renewable supplies are no longer available. The following graph (Figure 12-1) illustrates the PDA concept and the benefits of maximizing the use of renewable supplies in the early years when such supplies are fully available.

Figure 12-1 shows the benefits of using CAP supplies through 2040 and using excess Colorado River water through 2016. After 2040, no CAP water is expected to be available for use by non-Indian agriculture. Therefore, water use in the Pinal AMA would be mostly groundwater. The graph depicts the impacts on the amount of groundwater in storage at three different levels of water use over a 100-year period. These levels of water use are almost entirely a function of water demand by non-Indian agriculture. As indicated earlier, the average water demand for this sector has been close to 765,000 acre-feet per year. If this level of water use continues into the future, the AMA would not deplete its groundwater in storage to 1,000 feet until after 2100. Should non-Indian agricultural water use average

865,000 acre-feet per year, groundwater in storage would be depleted around 2085. As groundwater levels begin to decline in the next century, groundwater costs are expected to escalate. As the cost of pumping increases, there will be a point at which it will no longer be feasible for many farmers to continue to farm at historic land utilization rates. This point is dependent on the cost of energy and the depth of water, both of which vary widely across the AMA. At current energy costs, the maximum depth of affordable groundwater is between 700 and 900 feet. When groundwater is no longer affordable, water demand by the agricultural sector will diminish until water levels begin to rise again. Therefore, groundwater supplies will more than likely be available for agriculture well into the 22nd Century.

**FIGURE 12-1
PLANNED DEPLETION ALLOWANCE IMPACT
ON GROUNDWATER IN STORAGE
(PDA of 310,000 Acre-Feet per Year)
PINAL ACTIVE MANAGEMENT AREA**



12.3.2.2 Indian Water Use

Water demand projections for the Indian communities in the Pinal AMA will increase by approximately 50,000 acre-feet over the next 25 years. This increase in water use will be largely met by groundwater and by additional surface water supplies made available through canal lining projects. It is anticipated that the Gila River Indian Community, in conjunction with AWBA, will develop several recharge sites in the vicinity of the Gila River channel to store excess Colorado River water supplies. Groundwater pumping will continue, mostly to the east of I-10. Most of the groundwater pumping west of the freeway will be to reduce the effects of groundwater mounding associated with higher water tables. It is anticipated that Indian water use will have very little impact on the ability of the AMA to meet its management goal through 2025. The Gila River Indian Community has the potential to develop an additional 76,000 acres in the Pinal and Phoenix AMAs for agricultural production. It is projected that development of these acres will occur sometime between 2000 and 2040. When developed, the associated water demand would be satisfied through additional CAP water deliveries and groundwater pumpage. The amount of groundwater use will be dependent on the amount of CAP water entitlement awarded by the Indian water rights

settlement that is currently being negotiated. These additional Indian water demands may have a slight to moderate impact on the AMA management goal, depending on the amount of groundwater pumpage.

12.3.2.3 Outside Influences

12.3.2.3.1 Indian Water Rights Settlements

It is anticipated that over the next decade, Indian water rights settlements may reduce available CAP water supplies in the Pinal AMA. In essence, when Indian communities develop the infrastructure to deliver CAP water and ways to use it, it will result in non-Indian water users using more groundwater supplies. Water rights settlements may include water exchanges, groundwater pumping limitations, and the extinguishment of storage credits. Each of these potential settlement strategies could have a direct impact on non-Indian water users in the AMA.

12.3.2.3.2 Mesa Groundwater Transfers

The City of Mesa owns approximately 11,000 acres of farmland in the Eloy Subbasin. In the early 1990s, the Department approved Mesa's development plan that would allow it to retire the farmland for a future non-irrigation use. As long as Mesa continues to keep its development plan updated, it may retire the land from irrigation and receive up to 30,000 acre-feet per year for non-irrigation purposes. Mesa would have the right to withdraw groundwater in the subbasin and exchange it for CAP water to be used within its service area in the Phoenix AMA. The ability to exchange groundwater for CAP supplies has a strategic long-term benefit for the City of Mesa. However, it is very doubtful that the City would exercise its right to enter into any exchange agreement as long as excess Colorado River water supplies exist. Furthermore, an exchange would probably not be economically feasible as long as AWBA is in existence. Realistically, retirement of the Mesa farmland will probably not occur until after 2025.

12.3.3 Implications of Implementing the PDA

As previously mentioned, for the first time since the Code was enacted in 1980, the Department has defined the Pinal AMA management goal by determining the amount of groundwater in storage for both irrigation and non-irrigations uses and has developed guidelines to allow the planned depletion of these supplies over a long-term period. The PDA provides the Department, as well as the agricultural community, a "yardstick" with which to measure progress towards achieving the AMA's water management goal. The amount of available groundwater in storage to 1,000 feet has been dedicated for all water users for at least the next 100 years. Water in storage below 1,000 feet will be dedicated solely for future non-irrigation uses. The concept of an annual groundwater allowance makes it possible for the first time to manage the water resources of the AMA based upon its availability. This resource-based planning approach provides incentives for water users to maximize the use of renewable water supplies while they are plentiful by dramatically increasing groundwater resources for future use when renewable supplies are no longer available.

To account for annual increases or decreases in the amount of groundwater in storage, a groundwater storage account (GSA) will be maintained by the Department for the Pinal AMA. In years when groundwater is depleted at an annual rate less than the PDA, the Department will credit the difference to the GSA, and in years when groundwater withdrawals are in excess of the PDA, the difference will be debited. It should be noted that the PDA concept also allows water users to pump groundwater supplies that are naturally or artificially recharged on an annual basis.

In the future, if groundwater withdrawals were to exceed the PDA and continuous groundwater pumping had already exhausted all the credits in the GSA, the Department would recommend to AWBA that enough long-term storage credits be extinguished to offset any debits that may have accrued in the GSA.

12.3.4 Role of Conservation Requirements in Meeting the Management Goal

The efficient use of all water supplies will continue to play an important role in helping to achieve the Pinal AMA's water management goal. Water conservation leaves water in the ground and reduces the AMA's water demand over time. Even relatively modest reductions in water use will result in significant long-term savings. Efficient use of all water supplies is a reasonable goal and a component of the Department's mission statement. The strategy that is developed must address the issues of how to maintain the commitment to conservation during temporary periods of surplus and how to better integrate water conservation considerations into economic development activities.

A key question that must be answered during the third management period is: "How effective have the Department's conservation requirements been in ensuring that water users efficiently utilize their water supplies?" For instance, agricultural conservation requirements were established to allow holders of IGFRs to duplicate their highest historic water use from 1975 to 1980. Department analysis has shown that, for the most part, annual water use has been much lower than what has been allotted. Therefore, it is questionable that conservation requirements have induced farmers to employ water conservation practices. In fact, the cost of water has turned out to be the biggest incentive to implement efficient irrigation practices.

However, in the municipal conservation program, conservation requirements have been inducing water providers to employ state of the art conservation techniques in order to use water more efficiently. A problem that needs resolution is that private water companies are hesitant to invest in putting renewable supplies to use or making conservation-related improvements because they lack the authority to recover such costs uniformly across their customer base. There have been ongoing discussions between the Department and the Arizona Corporation Commission concerning pass-through of such investments to customers served by private water companies. Until this issue is resolved, private water companies may have difficulty meeting their conservation requirements and contributing to the Pinal AMA's water management goal.

12.4 FUTURE STRATEGIES TO ASSIST IN GOAL ATTAINMENT

Currently, the Pinal AMA is achieving its management goal as interpreted for the third management period. Based upon projections, the goal is achievable through 2025 with the continued use of renewable water supplies. Beyond 2025, maintaining the goal becomes more problematic because of dwindling supplies of agricultural CAP water. Therefore, it is vital that the Department explore ways now in which to maximize the use of renewable supplies in the AMA during the third and subsequent management periods.

The Department will work with local and regional entities to identify new strategies that may be implemented to address this issue. In order to develop a consensus response, a task force will be established for the Pinal AMA in order to develop alternative solutions. Some alternatives may impact other AMAs or even other areas of the state. These alternatives will need to be considered at the state level. All "big picture" issues relating to the basic structure and effectiveness of the Code provisions will be addressed by a statewide task force with representation from each major water use sector and each AMA.

Some of the important issues that will need to be addressed by the Department, the Pinal AMA task force, and the statewide task force include:

- The effectiveness of various Code provisions, including conservation programs, in achieving the management goal.

- Costs of renewable water supplies are not competitive with groundwater costs.
- Diminishing CAP water supplies for non-Indian agriculture.
- The impact of the recovery and extinguishment of storage credits on maintaining the management goal.
- The need for management of water resources in local areas with groundwater problems (“critical areas”).